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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/590,863

08/28/2006

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EXAMINER

SHEVIN, MARK L

ART UNIT

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1793

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/590,863	Applicant(s) OGASAWARA ET AL.	
	Examiner Mark L. Shevin	Art Unit 1793	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-13 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-13 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 28 August 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. ____. |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>12/20/2006 and 08/22/2008</u> . | 6) <input type="checkbox"/> Other: ____. |

DETAILED ACTION

Status

1. Claims 1-13, filed August 28th 2006, are pending.

Priority

2. Applicants' claim to foreign priority of Japanese patent application 2004-056245, filed march 1st, 2004, is recorded.

Information Disclosure Statements

3. The information disclosure statements submitted December 20th, 2006 and August 22nd, 2008 are in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statements have been considered by the examiner. Please refer to applicants' copies of the 1449 forms submitted herewith.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Joint Inventors

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This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 1-2, 9 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Bienvenu** (US 4,820,339) in view of **Alexander** (US 2,794,733) and **Martin** (WO 86/07097)

Bienvenu:

Bienvenu, drawn to the preparation of refractory metal powders such as titanium by reduction of their salts (col. 1, lines 1-15), teaches in Examples 1 and 2 in combination with the figure, a process of producing Ti powder from TiCl_4 due to reduction by Ca (col. 4, line 60 – col. 6, line 10). TiCl_4 (**4**) is blown into molten salt that contains dissolved Ca in the lower part of the reactor (**1**) and Ti powder is obtained and separated by separator (**9**). The molten salt may be a CaCl_2 – NaCl mixture (working temperature of 500 °C, see Example 2 and col. 3, lines 20-35).

Bienvenu teaches that the reduction reaction should be carried out in mixtures of fused halide salts which form eutectics (col. 1, line 65 to col. 2, line 5). With respect to obtaining Ca in the molten salt bath, Bienvenu uses a compound of a higher reducing power, in his case CaC_2 , to reduce the CaCl_2 to Ca in situ, which was proved to be yield good final powder (col. 2, lines 20-32) and makes it possible to regenerate the reaction bath (col. 2, lines 33-36).

Bienvenu did not teach that the Ca was produced by Na introduction.

Alexander:

Alexander, drawn to the production of alkaline earth metals such as Ca, Ba, and Sr by reduction from the corresponding chloride compounds using Na as the reductant (col. 1, lines 14-21), teaches that Ca can be produced by the addition of Na to CaCl_2 and performed in the temperature range of 385 - 600 °C (col. 1, lines 62 – col. 2, line 16).

Martin:

Martin, like Bienvenu, is drawn a process of producing titanium powder by reducing the metal halide with a molten alkali metal reducing agent (Abstract). Martin teaches that by passing liquid Na from an electrolytic reduction cell countercurrent to the by-product halides of said liquid metal reducing agent (NaCl and KCl) to regenerate potassium K from KCl (p. 5, lines 31-34) because liquid Na reduces K from its molten salts and would through retain K in the system and conserve heat. The liquid metal reducing agent comprises a metal selected from Group I, preferably a mixture of Na and K, but may contain at least one of Ca and Mg (p. 3, lines 21-27).

Regarding claim 1, it would have been obvious to one of ordinary skill in titanium production, at the time the invention was made, to combine the teachings of Bienvenu with Alexander and Martin to produce Ti or Ti alloy powder by reduction of Ca generated in a molten salt bath containing CaCl_2 by Na introduction as Bienvenu taught the process of reducing TiCl_4 precursor to Ti powder by the action of Ca dissolved in CaCl_2 and that Ca could be generated in situ by reducing CaCl_2 with another compound (col. 2, lines 20-32) and that this action makes it possible to regenerate the reaction

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bath (col. 2, lines 33-36) but did not teach Na introduction for this purpose. Martin teaches in an analogous alkali metal system that by passing liquid Na from an electrolytic reduction cell countercurrent to the by-product halides of said liquid metal reducing agent (NaCl and KCl) to regenerate potassium K from KCl (p. 5, lines 31-34) because liquid Na reduces K from its molten salts and would through retain K in the system and conserve heat and finally Alexander teaches that Ca can be produced by the addition of Na to CaCl_2 and performed in the temperature range of 385 - 600 °C (col. 1, lines 62 – col. 2, line 16). One would be motivated to introduce Na to the reaction bath of Bienvenu because Bienvenu taught that by generating Ca in situ it is possible to regenerate the reaction bath (col. 2, lines 33-36), Martin taught an analogous process using KCl instead of CaCl_2 , and finally Alexander teaches that free Ca can be produced by the addition of liquid Na.

Regarding claim 2, one would be motivated to add Na to the same reactor in which Ti is being generated as Bienvenu teaches that Ca is the reducing metal acting to reduce TiCl_4 to Ti powder and that Ca can be generated in situ by the reduction of CaCl_2 to Ca. (col. 2, lines 20-36). Furthermore, Martin teaches that introduction of Na counter-currently into the reactor as producing the reductant to reduce KCl to K (p. 5, lines 31-34) and that by providing additional liquid metal, greater heat transfer is allowed (p. 4, lines 6-24).

Regarding claim 9, Bienvenu disclosed a specific example where the molten salt was a CaCl_2 – NaCl mixture (working temperature of 500 °C, see Example 2 and col. 3, lines 20-35).

Regarding claim 13, it would have been obvious to one of ordinary skill in titanium production, at the time the invention was made, to maintain the Ca concentration not lower than 0.01% in the molten salt as Bienvenu suggested that Ca was the active reductant in producing Ti powder and one of ordinary skill would have optimize the amount of liquid metal reductant per Bienvenu and Martin to ensure efficient heat transfer and more or less equilibrium conditions as Martin taught that excess liquid metal reductant acts as a carrier and heat transfer medium (p. 5, lines 6-24).

5. Claims 3, 5, 6, and 10-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Bienvenu** in view of **Alexander** and **Martin** as applied to claims 1-2, 3, 9 and 13 above, in further view of **Anderson** (WO 2004/022800A1 – further incorporating the disclosures of US 5,779,761 and US 6,409,797 by reference).

The disclosures of Bienvenu, Alexander, and Martin were discussed in the 103 rejections above, however the aforementioned references do not teach or suggest electrolyzing a molten salt containing NaCl and returning the Na to the Ti-production reactor.

US 5,779,761:

US '761, like Bienvenu, is drawn to a method of continuously producing titanium from a halide precursor by reduction using alkali or alkaline earth metals (Abstract). US '761 teaches that the greatest potential for decreasing the cost of titanium production is through the development of continuous production processes with their attendant reduction in material handling over previous batch processes (col. 1, lines 33-40).

As shown in Fig. 1, TiCl_4 vapor is flowed into a molten Na stream, which carries the resultant Ti powder and NaCl to be separated. NaCl is sent to an electrolytic cell (12) where the regenerated Na is recycled back to further reduce TiCl_4 and the Cl_2 gas is sent to the ore chlorinator (15) to turn TiO_2 ore into TiCl_4 feedstock.

Li, K, and Ca may be used in addition to, or instead of Na as a reductant (col. 5, line 65 to col. 6, line 10).

US 6,409,797:

US '797, like Bienvenu and US '761 above, is drawn to a method of continuously reducing TiCl_4 to Ti powder using a liquid metal reductant such as Na. In addition to what was taught by US '761, US '797 adds that the temperature of the liquid metal reductant away from the TiCl_4 introduction point is maintained between 200 and 600 °C (col. 4, lines 12-24). Furthermore, the particle size of the Ti powder was 0.1 - 10 microns with a mean size of 5.5 microns (col. 7, lines 40-48).

WO 2004/022800:

WO '800, like Bienvenu and both US' 761 and US '797, is drawn to the production of Ti particles by the reduction TiCl_4 with Na (p. 1, last para). WO '800 teaches that titanium or a titanium alloy may be made by the reduction of TiCl_4 vapor or a plurality of halide vapors for an alloy by an alkali or alkaline earth metal such as Na or Mg and that alloys are easily made by mixing the halide vapors in the appropriate quantities and reducing them just as one would reduce a single halide vapor (p. 4, para 3).

WO '800 teaches that separation of the product from the reaction slurry is the most difficult aspect in engineering of the continuous process (p. 1, last para) and that liquid metal, salt particulates, and titanium particulates leave the nozzle (20) and enter vessel (15) where liquid Na is separated by gravity (least dense phase at the top of the vessel) and siphoned off as shown in Figure 1 (p. 5, para 2). As particulates settle in the lower portion (18) of the vessel (15), the particulate concentration is increased due to removal of sodium through line (29). Upon actuation of the valve (40), concentrated slurry will drain through the outlet or exit (19) through line (42) in the filter assembly (45).

The filter assembly is maintained at temperatures sufficient to keep molten salt in a liquid phase and titanium particles collect on the filter plate (37) while molten salt passes through the filter plate through line (61) to be returned to an electrolytic cell (p. 5, para 3).

Regarding claim 3, it would have been obvious to one of ordinary skill in titanium production, at the time the invention was made, to combine the previously-established combination of Bienvenu, Alexander, and Martin with Anderson to regenerate Na by electrolyzing molten salt containing NaCl as US '761 taught that NaCl is sent to an electrolytic cell (12) where the regenerated Na is recycled back to further reduce TiCl_4 and the Cl_2 gas is sent to the ore chlorinator (15) to turn TiO_2 ore into TiCl_4 feedstock and US '761 further taught that recycling such a waste stream has significant benefits with respect to both improve economy of operation and substantially reduced environmental impact (col. 4, lines 34-40) and the TiCl_4 could also be sold to other

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titanium manufacturers (col. 4, lines 50-55). Martin also taught that by passing liquid Na from an electrolytic reduction cell countercurrent to the by-product halides of said liquid metal reducing agent (NaCl and KCl) to regenerate potassium K from KCl (p. 5, lines 31-34).

Regarding claim 5, it would have been obvious to one of ordinary skill in titanium production, at the time the invention was made, to pass the molten salt separated from the Ti powder to an electrolytic step as WO '800 taught that molten salt passes through the filter plate through line (61) to be returned to an electrolytic cell (p. 5, para 3) while the Ti powder is separated out and recovered through line (56). One would be motivated to pass the molten salt to an electrolytic cell to recover the Na used to generate Ca and to recover Cl_2 gas for chlorinating the titanium ore to generate TiCl_4 feedstock

Regarding claim 6, it would have been obvious to one of ordinary skill in titanium production, at the time the invention was made, to recycle the Cl_2 from the NaCl electrolysis reactor to chlorinate titanium ore to form TiCl_4 feedstock, as US '761 taught that NaCl is sent to an electrolytic cell (12) where the regenerated Na is recycled back to further reduce TiCl_4 and the Cl_2 gas is sent to the ore chlorinator (15) to turn TiO_2 ore into TiCl_4 feedstock and US '761 further taught that recycling such a waste stream has significant benefits with respect to both improve economy of operation and substantially reduced environmental impact (col. 4, lines 34-40) and the TiCl_4 could also be sold to other titanium manufacturers (col. 4, lines 50-55).

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Regarding claim 10, it would have been obvious to one of ordinary skill in titanium production, at the time the invention was made, to add one or more of KCl, LiCl, and CaF_2 to the molten NaCl-CaCl₂ salt of Bienvenu as Bienvenu taught that the reduction reaction should be carried out in mixtures of fused halide salts which form eutectics (col. 1, line 65 to col. 2, line 5) and US '761 taught that Li, K, and Ca may be used in addition to, or instead of Na as a reductant (col. 5, line 65 to col. 6, line 10). One of ordinary skill would be motivated to add a further salt to reduce the operating temperature of the reactor by lowering the melting temperature of the fused salt bath.

Regarding claim 11, it would have been obvious to one of ordinary skill in titanium production, at the time the invention was made, to use a mixture of TiCl₄ and another metallic chloride to form a Ti alloy as WO '800 taught that titanium or a titanium alloy may be made by the reduction of TiCl₄ vapor or a plurality of halide vapors for an alloy by an alkali or alkaline earth metal such as Na or Mg and that alloys are easily made by mixing the halide vapors in the appropriate quantities and reducing them just as one would reduce a single halide vapor (p. 4, para 3).

Regarding claim 12, one of ordinary skill in titanium production would have reasonably expected the Ti powder produced to be within the claimed size range as substantially similar processes yield substantially similar products. From MPEP 2112, para. V, subpara 1: "[T]he PTO can require an applicant to prove that the prior art products do not necessarily or inherently possess the characteristics of his [or her] claimed product. Whether the rejection is based on 'inherency' under 35 U.S.C. 102, on

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'*prima facie* obviousness' under 35 U.S.C. 103, jointly or alternatively, the burden of proof is the same..."

Furthermore, Bienvenu taught the particle size of the Ti powder as in the range of 0.5 – 3 microns (col. 6, lines 26-32) and US '797 taught that the particle size of the Ti powder produced was 0.1 - 10 microns with a mean size of 5.5 microns (col. 7, lines 40-48) and it would have been obvious to one of ordinary skill in the art at the time of the invention to choose the instantly claimed ranges through process optimization, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. See In re Boesch, 205 USPQ 215 (CCPA 1980).

6. **Claims 4, 7, and 8** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Bienvenu** in view of **Alexander, Martin, and Anderson** as applied to claims 3, 5, 6, and 10-12 above, in further view of **Winter** (US 2,890,112)

The disclosures of Bienvenu, Alexander, Martin, and Anderson were discussed in the 103 rejections above, however the aforementioned references do not teach or suggest the temperature of the molten salt during electrolysis.

Winter:

Winter, drawn to a method of producing Ti metal by reduction of precursor halide salts, teaches that the by-product salt composition generated after formation of Ti powder is recovered by electrolysis in a molten salt electrolytic cell to produce Na metal, Mg-Ca alloy, and Cl₂ with the products being separately recycled for reuse in the

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process (col. 2, lines 1-12). The electrolytic cell operates at a temperature of 520 - 900 °C as per conventional design and operation of such a sodium cell (col. 2, lines 15-30).

Regarding claim 4, it would have been obvious to one of ordinary skill in titanium production, at the time the invention was made, to combine the previously-established combination of Bienvenu, Alexander, Martin, and Anderson with Winter to operate the electrolytic cell at a temperature above 600 °C as one would have been expected to choose the instantly claimed ranges through process optimization, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. See In re Boesch, 205 USPQ 215 (CCPA 1980).

Regarding claim 7, it would have been obvious to one of ordinary skill in titanium production, at the time the invention was made, to increase the temperature of the molten salt separated from said Ti powder to more than 600 °C to separate out any generated Na before supplying it to the electrolytic cell as WO '800 teaches an alternate embodiment (Figure 2) where the liquid salt is maintained at an elevated temperature of about 850 °C to keep NaCl molten and liquid Na is separated off from separator (97) while NaCl continues through the gravity separator to be electrolyzed (p. 7, para 1). Motivation to heat the salt mixture above 600 °C to recover Na comes from the suggestions of WO '800 to recover as much Na as possible before sending the remaining salt mixture to the electrolytic cell as evidenced by the sodium gravity recovery and pumping system of Figure 1 and the gravity separator of Figure 2.

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Regarding claim 8, it would have been obvious to one of ordinary skill in titanium production, at the time the invention was made, to have the Na separation step double as the Ti separation step as WO '800 taught an externally heated filtered vessel (45) where Ti powder is separated from the salt mixture and one of ordinary skill would be motivated to separate Na in the same step by the previously suggested methods such as gravity separation to conserve energy.

Conclusion

-- Claims 1-13 (All pending) are rejected

-- No claims are allowed

The rejections above rely on the references for all the teachings expressed in the text of the references and/or one of ordinary skill in the metallurgical art would have reasonably understood or implied from the texts of the references. To emphasize certain aspects of the prior art, only specific portions of the texts have been pointed out. Each reference as a whole should be reviewed in responding to the rejection, since other sections of the same reference and/or various combinations of the cited references may be relied on in future rejections in view of amendments.

All recited limitations in the instant claims have been met by the rejections as set forth above. Applicant is reminded that when amendment and/or revision is required, applicant should therefore specifically point out the support for any amendments made to the disclosure. See 37 C.F.R. § 1.121; 37 C.F.R. Part §41.37 (c)(1)(v); MPEP §714.02; and MPEP §2411.01(B).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mark L. Shevin whose telephone number is (571) 270-3588 and fax number is (571) 270-4588. The examiner can normally be reached on Monday - Friday, 8:30 AM - 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy V. King can be reached on (571) 272-1244. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Mark L. Shevin/

/Roy King/

Supervisory Patent Examiner, Art Unit 1793

10-590,863
November 3rd, 2008